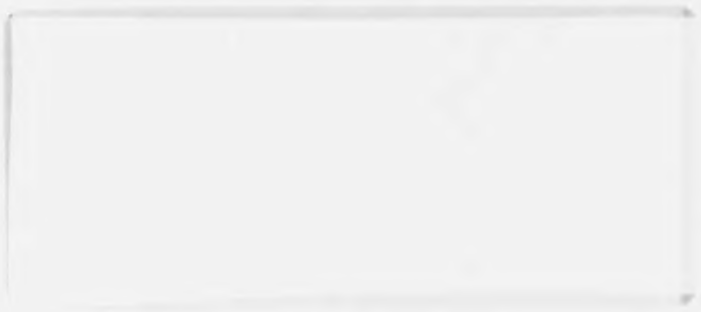
SKULL AND DENTAL MEASUREMENTS FROM ADULT FEMALE CARIBOU COLLECTED FROM VICTORIA ISLAND AND PELLY BAY, NWT, 1987-1990.

Northwest Territories Renewable Resources



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SKULL AND DENTAL MEASUREMENTS FROM ADULT FEMALE CARIBOU COLLECTED FROM VICTORIA ISLAND AND PELLY BAY, NWT, 1987-1990.

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ABSTRACT

We collected adult female caribou skulls from 1987 to 1990 from Pelly Bay and Victoria Island to compare measurements of skull and dental features. Tooth wear ratios were calculated and not found significantly different between the two groups reflecting similarities in forage conditions and age rather than taxonomy. Pelly Bay skulls were significantly larger than Victoria Island skulls. The skull measurements were compared to published skull data from Boothia, Melville Island, Prince of Wales Island and Dolphin and Union Strait. Boothia measurements were largest overall except for basal length. The smallest measurements came from Melville and Prince of Wales island skulls. Victoria Island and the Dolphin and Union group were not significantly different for seven out of eight skull measurements. Most variation between groups occurred for basal length measurements.

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INTRODUCTION

In the late 1970s and into the 1980s, hunters reported the reappearance of caribou on southern and central Victoria Island (Gunn 1990). Caribou had virtually disappeared from Victoria Island between the 1920s and the late 1970s. At the time of their disappearance, the caribou were known for their seasonal migration to the mainland for the winter. Tens of thousands would cross Dolphin and Union Strait and consequently the caribou were known as the Dolphin and Union herd. For unknown reasons although hunting may have been a factor, the caribou migration rapidly dwindled and had stopped by the 1920s (Manning 1960). Inukshuks and shooting pits at various sites along both the mainland and the southern Victoria coast are evidence that the migration was centuries old but not whether the migration had failed before.

Manning (1960) described a cline in skull measurements and pelage extending from the arctic islands through Banks Island, to the Dolphin and Union herd to mainland caribou. Two characteristics (antler velvet colour and hoof width) were similar between all arctic island caribou and discontinuous with the mainland caribou. Manning concluded (1960:45) that the Dolphin and Union herd ". . . was separated rather sharply from neighbouring mainland caribou in pelage colour, and the available skulls indicate that the migrants were distinctively smaller although the difference in skull shape was comparatively slight." Based on his examination of skulls and winter skins, Manning (1960) classified both Banks and the migrant Dolphin and Union herd as part of a cline joining typical *arcticus* and *pearyi*. He tentatively labelled the Dolphin and Union herd as *Rangifer arcticus arcticus*.

The return of caribou to Victoria Island raised the question as to whether the caribou were more akin to *arcticus* (now called *groenlandicus*) or *pearyi*. The first step in our objective to classify the caribou was to obtain skull and body measurements. This report describes the skull measurements of adult female caribou collected on southern Victoria Island and compares them with a sample of mainland caribou.

METHODS

From 1987 to 1990, caribou were collected from Pelly Bay and Victoria Island. Specimens were collected in April, 1987 - 1990 from sites within 100km of Cambridge Bay while no.s 7760 to 7769 were satellite-collared caribou collected after their movements had been monitored (Appendix A). The rest of the specimens were winter kill pick-ups from 1989. All Pelly Bay specimens were collected in April, 1988 (Appendix B). Skull and dental measurements were taken from adult females using digital calipers to the nearest 0.01 mm. Skull measurements were taken following Thomas and Everson (1982). Data were analyzed using Sigmastat statistical software (Jandel 1992). We used pair-wise t-tests to compare means of skull measurements and dental measurements among locations. Where tests for normality and equal variance failed, the Mann-Whitney rank sum test was applied to determine whether the medians differed significantly. Confidence intervals were graphed for those measurements that measured significant differences from these results. Skull data from Thomas and Everson (1982) and Manning (1960) were used to compare the Melville Island, Boothia, Dolphin and Union, and Prince of Wales samples. Standard errors for the Melville Island, Boothia and Prince of Wales data were calculated as:

$$SE = SD/\sqrt{n}$$

First mandibular molar width and height, and length of the premoiar row measurements were taken from both sides of the jaw. These measurements were averaged and used to calculate tooth wear ratios (Tyler 1987):

$$\text{Tooth wear ratio} = 1 - [(m2^{2}/m1)/pm]$$

where,

m1 = length of first mandibular molar

m2 = height of first mandibular molar

pm = length of premolar row

RESULTS and DISCUSSION

Table 1 and 2 show mean skull measurements and relevant statistical information for Victoria Island (n = 70) and Pelly Bay (n = 22) measurements collected for this study. Pelly Bay skulls are significantly larger than Victoria Island caribou skulls. This is shown in figures 1 - 4 where significantly different mean measurements with 95% C. I. are graphed.

Thomas and Everson (1982) based part of their study on seven morphological characteristics of the Peary caribou skull that were least affected by nutritional differences in populations. If significant differences were found between populations in these measurements then this would possibly reflect genetic differences. The least variable skull characteristics were zygomatic width, basal length, orbital width, mastoid width, mandibular length, maxillary tooth row, and diastema length. Table 3 shows these skull measurements (except diastema length) for six different groups of caribou skull collections. The Boothia sample was greatest for all parameters measured but similar to Pelly Bay except for basal length. The smallest measurements were from Melville and Prince of Wales islands. The percent deviation of mean skull measurements from Victoria Island measurements are graphed in Figure 5 to show how the different populations compare.

Manning (1960) reported condobasal length as being most relevant to total body size and skull length. He also concluded there were greater differences between populations in anterior skull measurements and less different in skull width measurements. Victoria Island and Dolphin and Union measurements of condobasal lengths were very similar and did not test significantly different (Table 3 and 4) while the Pelly Bay group measured significantly larger. There were no significant differences between Victoria Island and Dolphin and Union measurements except for nasal length. The highly significant difference in this measurement is probably due to a difference in measuring technique. Most variation between populations occurs in basal length. Unfortunately no measurement is available for the Dolphin and Union group.

Table 1. Mean skull measurements (mm) for female adult caribou from Victoria Island, 1987-90

	n	mean ± SE	S.D.	CV
basal l.	64	278.12 ± 1.27	10.32	3.70
orbital w.	61	144.51 ± 0.69	5.60	3.83
nasal l.	73	80.93 ± 0.96	8.39	10.37
post nares	63	36.12 ± 0.26	2.15	6.00
max.tooth rw.	74	84.37 ± 0.46	4.08	4.84
max. diastema	62	100.42 ± 0.68	5.53	5.45
occipital ht.	71	111.52 ± 0.72	6.20	5.59
nasal w.	73	49.85 ± 0.52	4.58	9.19
canine w.	71	53.81 ± 0.42	3.67	6.84
incisive foramen	61	40.49 ± 0.42	3.30	8.17
mastiod w.	76	94.38 ± 0.40	3.58	3.77
rostral ht.	72	78.83 ± 0.45	3.86	4.52
zygomatic w.	71	119.47 ± 0.38	3.27	2.74
mandibular l.	65	234.89 ± 1.31	10.69	4.59
mandibular ht.	65	99.24 ± 0.78	6.39	6.48
mand. tooth row	78	94.61 ± 0.56	5.03	5.29
mand. diastema w.	71	88.01 ± 0.78	6.67	7.57
condobasal l.	63	297.83 ± 1.31	10.54	3.52

Table 2. Mean skull measurements (mm) for female caribou from Pelly Bay, 1988

	n	mean ± SE	SD	CV
basal l.	14	296.74 ± 3.08	11.52	3.88
orbital w.	17	147.58 ± 1.31	5.41	6.67
nasal l.	19	85.78 ± 1.88	8.19	9.55
post nares	12	38.35 ± 0.61	2.10	5.48
max.tooth rw.	20	87.74 ± 1.00	4.38	4.99
max. diastema	14	108.22 ± 1.52	5.68	5.25
occipital ht.	19	120.29 ± 1.33	5.81	4.83
nasal w.	20	51.41 ± 1.05	4.71	9.16
canine w.	19	56.69 ± 1.11	4.86	8.57
incisive foramen	14	43.84 ± 1.47	5.49	12.52
mastiod w.	21	98.62 ± 1.41	6.45	6.54
rostral ht.	20	82.25 ± 1.03	4.58	5.57
zygomatic w.	18	122.26 ± 1.08	4.58	3.75
mandibular l.	20	247.45 ± 1.85	8.26	3.34
mandibular ht.	19	98.23 ± 1.12	5.24	5.33
mand. tooth row	22	97.35 ± 1.12	5.24	5.38
mand. diastema w.	22	93.63 ± 1.22	5.71	6.10
condobasal l.	14	317.86 ± 3.21	11.99	3.77

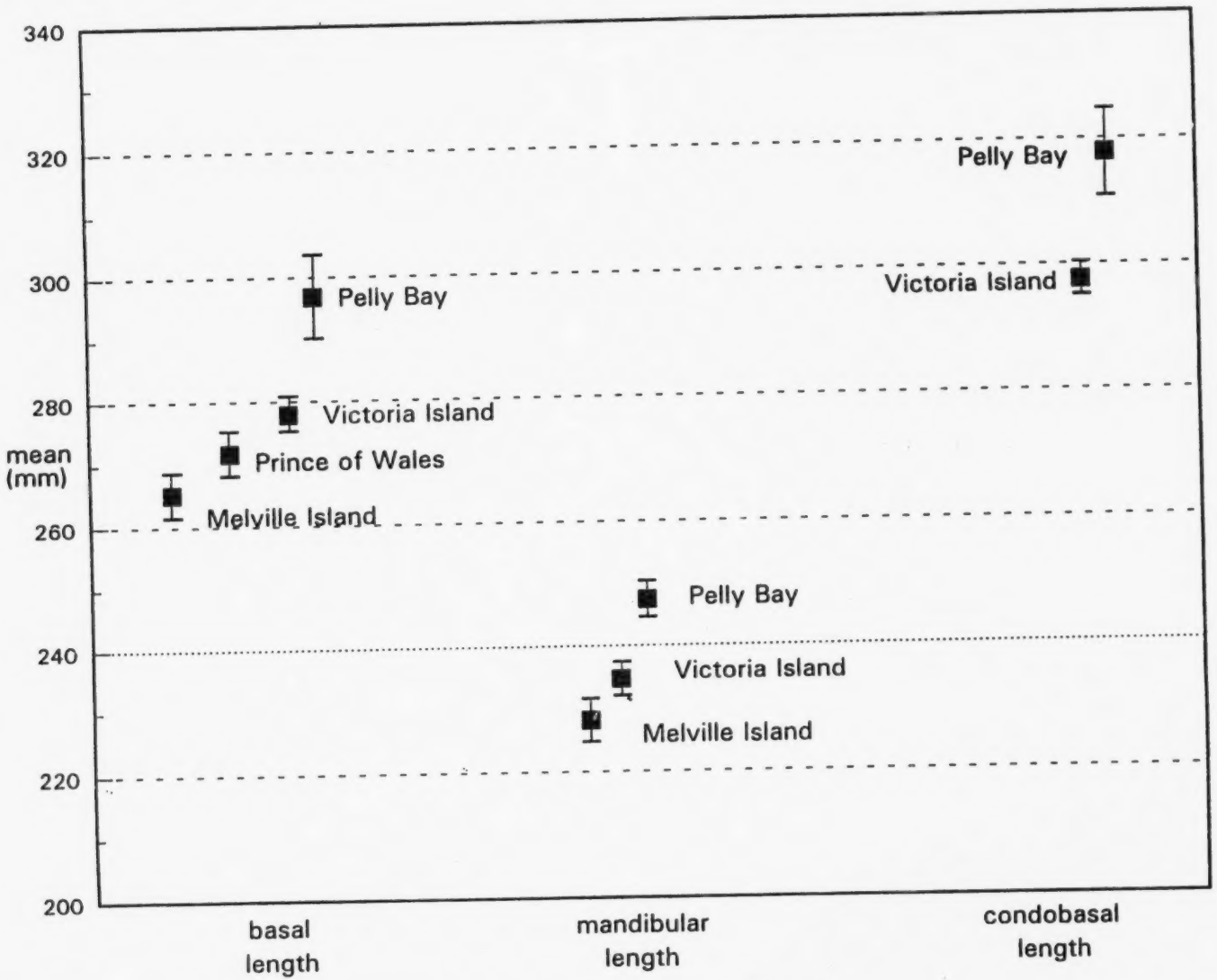

Figure 1. 95% confidence intervals for basal l., mandibular l., and condobasal l. .

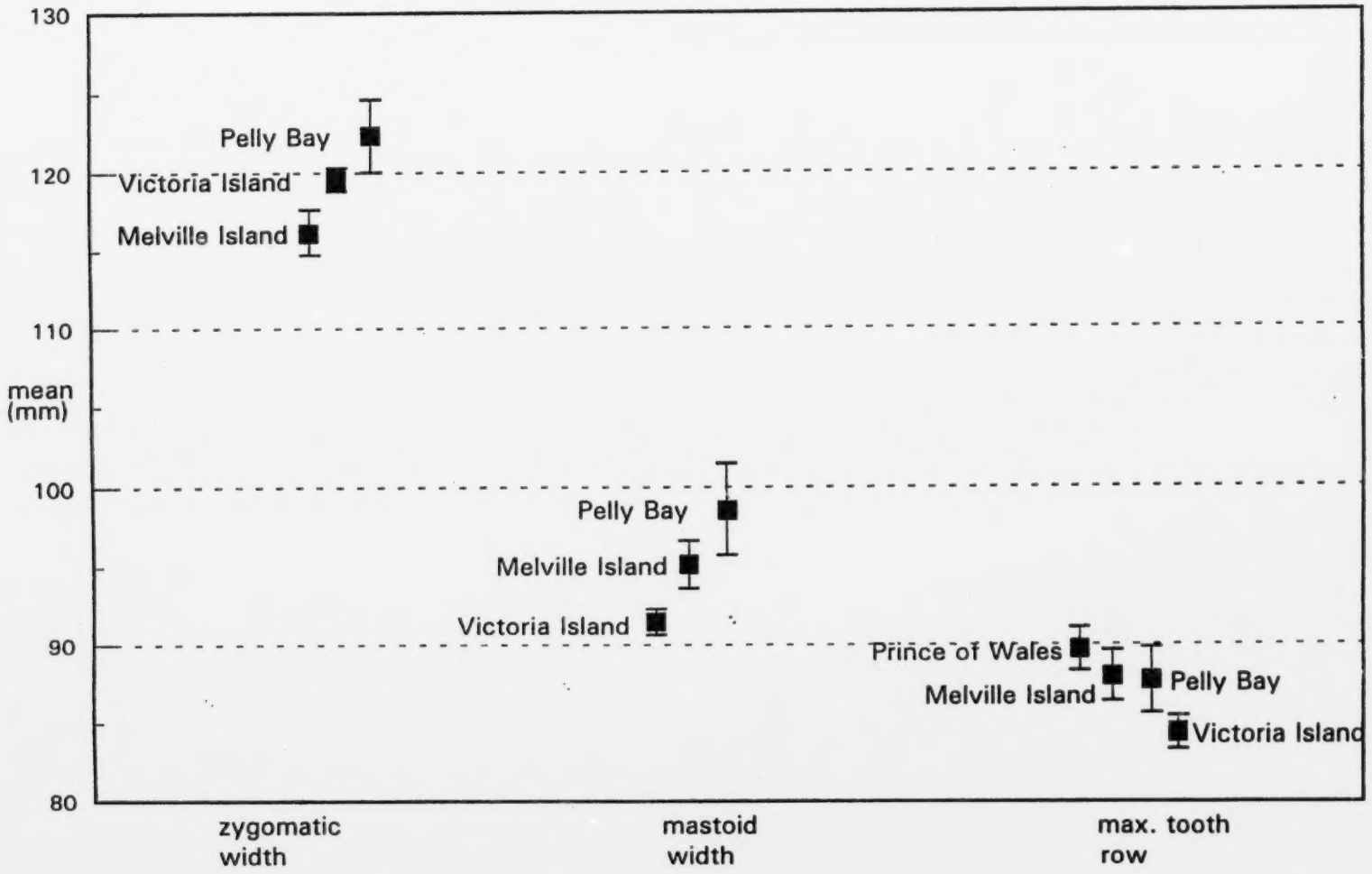

Figure 2. 95 % confidence intervals for zygomatic w., mastoid w.,and max. tooth row.

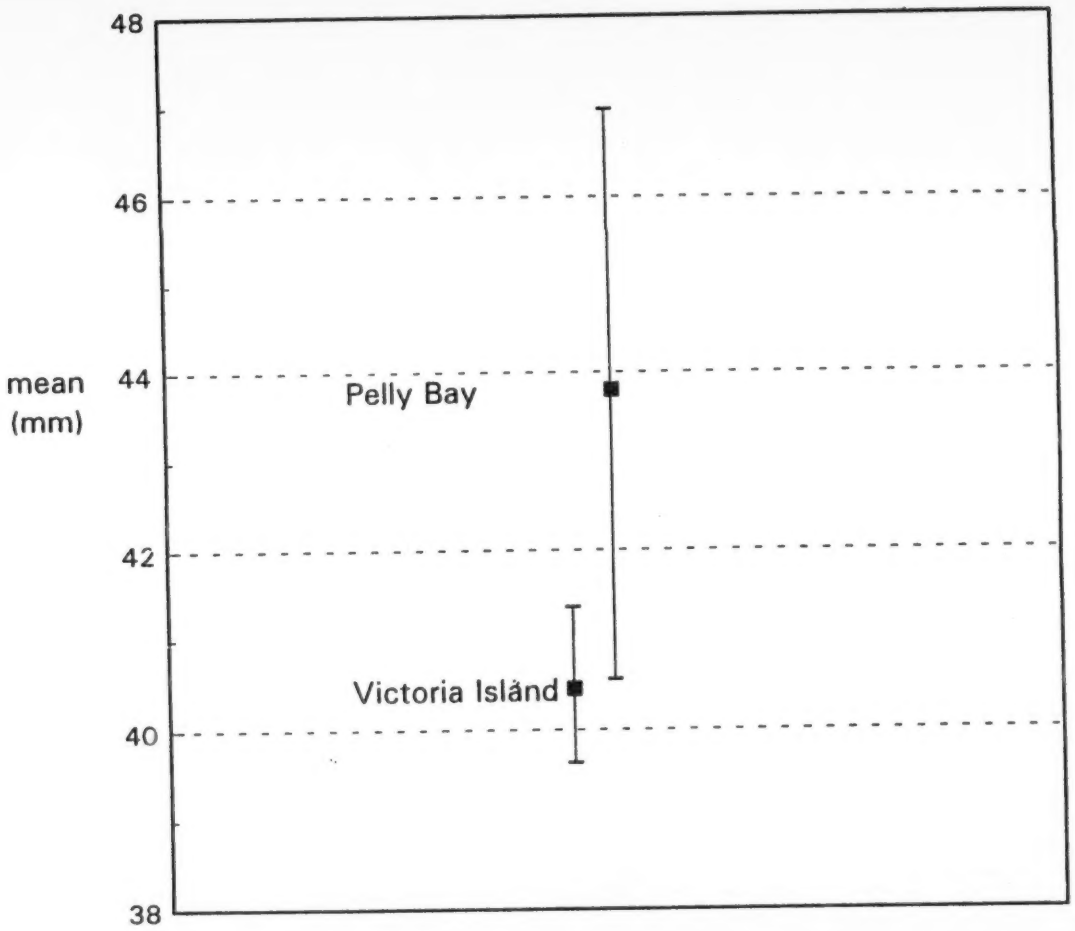

Figure 3. 95% confidence intervals for incisive foramen.

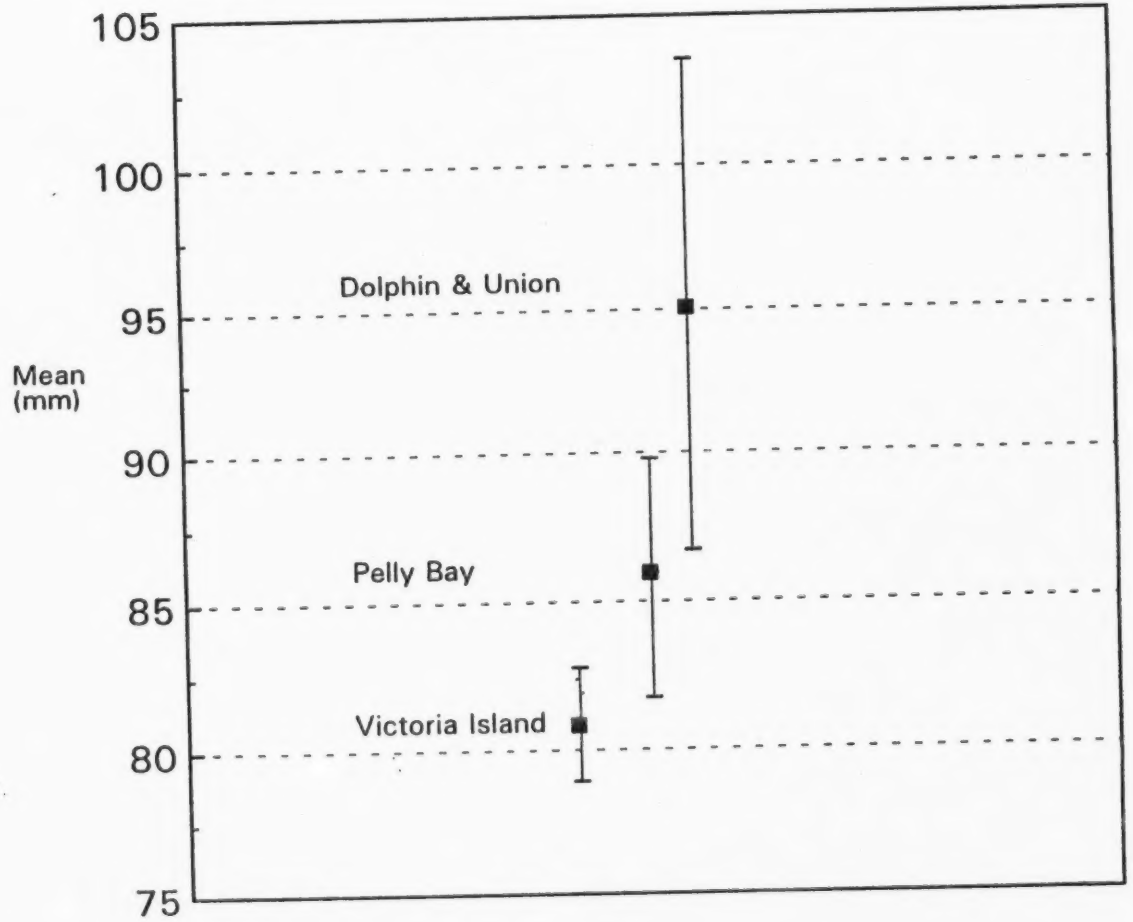

Figure 4. 95% confidence intervals for nasal length.

Table 3. Mean skull measurements (mm) among six locations for female adult caribou.

	Victoria Island $\bar{x} \pm SE$	Boothia [1]	Melville Island [1]	Prince of Wales [1]	Dolphin & Union [2]	Pelly Bay
basal l.	278.1 ± 1.27	286.1 ± 5.90	264.9 ± 1.69	271.4 ± 1.65	NA	296.7 ± 3.08
(n)	(64)	(7)	(23)	(21)		(14)
zygomatic w.	119.5 ± 0.38	123.7 ± 1.58	116.1 ± 0.67	118.6 ± 0.64	117.5 ± 1.94	122.3 ± 1.08
	(71)	(7)	(24)	(23)	(7)	(18)
mandibular l.	234.9 ± 1.31	244.5 ± 4.99	227.9 ± 1.61	233.2 ± 1.34	239.8 ± 2.50	247.5 ± 1.85
	(65)	(8)	(19)	(22)	(5)	(20)
orbital w.	144.5 ± 0.69	150.7 ± 2.38	145.4 ± 1.31	144.1 ± 0.63	144.4 ± 1.50	147.6 ± 1.31
	(61)	(7)	(24)	(24)	(7)	(17)
mastoid w.	94.4 ± 0.40	98.9 ± 1.59	95.1 ± 0.71	94.1 ± 0.83	93.7 ± 1.26	98.6 ± 1.41
	(76)	(8)	(24)	(23)	(7)	(21)
max. tooth rw.	84.4 ± 0.56	91.1 ± 1.20	87.9 ± 0.76	89.7 ± 0.65	87.2 ± 0.97	87.7 ± 1.00
	(74)	(8)	(24)	(24)	(7)	(20)
condobasal l.	297.8 ± 1.31	NA	NA	NA	296.7 ± 3.66	317.9 ± 3.21
	(63)				(7)	(14)
inc. for.	40.5 ± 0.42	NA	NA	NA	38.1 ± 1.49	43.8 ± 1.47
	(61)				(6)	(14)
nasal l.	80.9 ± 0.96	NA	NA	NA	95.1 ± 3.43	85.8 ± 1.88
	(73)				(7)	(19)

[1] Thomas and Everson 1982
[2] Manning 1960

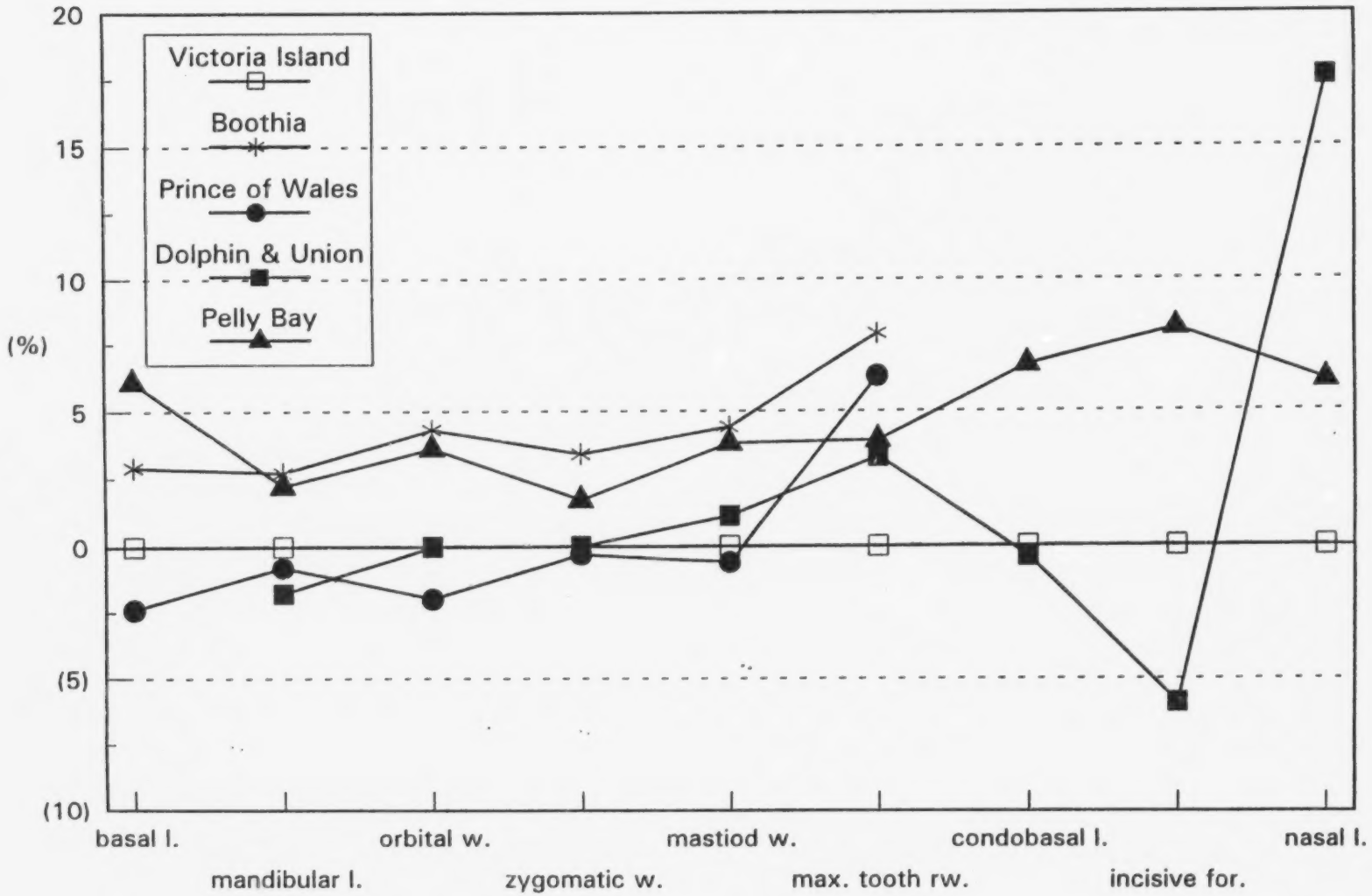

Figure 5. Percent deviation of mean skull measurements from Victoria Island

Table 4. Paired comparisons with Victoria Island of mean skull measurements

	Victoria Island vs Pelly Bay		Victoria Island vs Dolphin & Union		Victoria Island vs Prince of Wales Isl.	
	t-test	differ significantly *	t-test	differ significantly *	t-test	differ significantly *
basal l.	6.03 df = 75 (P < 0.001)	*	–		2.68 df = 83 P = 0.009	*
zygomatic w.	T = 1046[1] (P = 0.032)	*	1.50 df = 76 P = 0.143		1.26 df = 92 P = 0.210	
mandibular l.	4.80 df = 84 (P < 0.001)	*	1.00 df = 68 P = 0.314		0.71 df = 85 P = 0.479	
orbital w.	2.00 df = 75 (P = 0.054)		0.05 df = 67 P = 0.964		0.33 df = 84 P = 0.744	
mastoid w.	T = 1382[1] (P = 0.006)	*	0.90 df = 81 P = 0.375		0.70 df = 97 P = 0.490	
max. tooth rw.	3.30 df = 91 (P = 0.001)	*	1.65 df = 79 P = 0.104		5.40 df = 96 P < 0.001	*
condobasal l.	6.10 df = 74 (P < 0.001)	*	0.27 df = 68 P = 0.792		–	
inc. for.	T = 708.5[1] (P = 0.058)	*	1.68 df = 65 P = 0.099		–	
nasal l.	2.30 df = 90 (P = 0.025)	*	4.30 df = 78 P < 0.001	*	–	

[1] Mann-Whitney Rank Sum test (normality failed)

The mean tooth wear ratios for Victoria Island and Pelly Bay were not significantly different as shown in Table 5. This would reflect similarities in forage conditions and age rather than taxonomy. Dental measurements were not collected for the other groups.

These results will be incorporated into a more comprehensive approach to discerning the taxonomy of the Victoria Island caribou using DNA and protein electrophoresis, and ecological characters.

Table 5. Mean tooth wear ratios (mm) for adult female caribou.

	Pelly Bay (n = 22)			Victoria Island (n = 80)			diff. in means	P
	mean ± SE	S.D.	CV	mean ± SE	S.D.	CV		
PM. length	40.54 ± 0.65	3.06	7.6	39.42 ± 0.25	2.27	5.6	1.12	0.05 (t = 2.00)
M1 length	15.31 ± 0.19	0.91	5.9	14.85 ± 0.09	0.85	5.7	0.43	0.06 (t = 1.90)
M2 ht.	10.51 ± 0.43	2.05	19.5	9.96 ± 0.22	2.03	20.4	0.81	0.32* (T = 1256)
Ratio	0.82 ± 0.01	0.06	7.3	0.83 ± 0.01	0.06	7.2	0.01	0.54 (t = 0.61)

* Mann-Whitney Rank Sum Test

ACKNOWLEDGEMENTS

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Appendix A. Female caribou skull measurements (mm) - Victoria Island

#	Date	Age	basal l.	orbital w.	nasal l.	post nares	max. tooth rw.	max. diast.	occip. ht.	nasal w.	canine w.	inc. for.	mastoid w.	rostral ht.	zygom. w.	mand. l.
231	1987	old	296.22	-	82.63	-	-	109.79	-	45.54	57.06	35.93	95.88	-	-	-
232	1987	adult	288.78	-	96.32	-	87.19	101.90	116.35	57.71	58.82	42.40	95.25	81.74	-	-
233	1987	adult	277.99	144.62	83.30	-	85.33	98.16	113.83	55.54	53.10	40.45	89.56	78.81	114.56	231.46
235	1987	adult	-	143.42	60.89	37.47	86.27	-	111.31	44.82	51.34	-	95.21	82.44	119.53	225.80
236	1987	old	288.24	149.55	95.90	-	78.51	106.51	114.84	55.36	54.02	38.22	95.61	84.19	121.89	239.77
237	1987	old	-	-	-	-	-	-	-	-	-	-	-	-	-	-
340	1987	adult	278.43	135.24	72.03	33.88	85.37	103.64	110.58	44.32	52.76	40.15	91.98	81.12	116.75	238.91
341	1987	adult	-	144.08	72.48	34.01	89.04	-	113.49	42.06	54.73	-	92.61	78.77	121.99	231.09
345	1987	adult	-	149.24	89.29	37.52	85.85	-	125.6	45.91	59.20	-	96.91	87.96	125.74	252.56
347	1987	adult	273.71	143.16	63.77	35.93	85.80	96.26	110.96	35.79	52.07	41.63	96.11	79.84	119.76	228.99
348	1987	adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-
349	1987	adult	-	146.89	-	-	-	-	-	44.98	-	-	95.99	-	121.72	-
350	1987	adult	277.71	142.36	85.21	35.82	88.26	100.85	114.83	50.35	48.88	42.39	88.25	79.84	119.27	229.16
351	1987	adult	289.47	148.18	85.90	42.24	83.71	110.01	120.09	53.72	56.39	46.15	102.71	87.96	126.51	243.31
352	1987	adult	272.33	143.92	78.63	34.32	88.42	92.08	111.23	51.96	52.63	35.06	94.23	74.83	119.49	228.09
353	1987	adult	274.78	144.96	83.11	36.19	80.14	99.27	114.09	56.2	53.20	40.93	98.13	73.89	123.51	-
354	1987	adult	269.28	143.90	81.15	35.97	70.36	103.21	108.81	47.67	56.28	38.98	95.23	79.47	121.32	222.74
431	1988	adult	277.99	152.55	86.78	34.88	87.96	96.80	107.35	53.57	54.53	40.16	94.16	76.17	119.54	238.66
432	1988	adult	277.54	-	78.85	-	85.92	103.88	106.97	-	56.33	-	96.07	81.64	-	-
433	1988	adult	298.21	-	65.86	40.15	84.33	110.53	119.84	38.01	60.20	41.88	99.43	85.06	126.16	252.42

Appendix A. continued...

#	Date	Age	basal l.	orbital w.	nasal l.	post nares	max. tooth rw.	max. diast.	occip. ht.	nasal w.	canine w.	inc.for.	mastiod w.	rostral ht.	zygom. w.	mand.l.
434	1988	adult	271.17	-	79.35	36.48	85.74	97.36	107.51	48.12	51.51	40.87	93.53	78.24	-	231.4
435	1988	adult	265.34	-	76.77	37.54	86.51	98.11	106.64	55.5	50.46	40.91	89.25	69.04	119.29	220.57
436	1988	adult	273.84	147.56	77.71	37.75	90.26	93.32	113.1	51.41	56.30	39.34	91.94	74.09	119.13	227.88
438	1988	adult	275.62	144.86	71.57	34.36	81.69	98.94	108.86	46.64	50.77	40.31	96.09	81.84	114.93	232.41
440	1988	adult	274.27	-	69.99	37.86	91.89	98.84	108.21	43.4	53.03	38.51	90.60	75.87	117.81	230.84
442	1988	adult	302.21	156.77	92.92	38.19	87.30	111.69	117.69	57.01	54.10	43.53	96.83	80.80	121.09	256.62
443	1988	old	299.63	155.16	105.43	39.17	88.47	107.98	119.56	50.49	58.49	42.43	101.58	81.98	126.14	248.04
444	1988	adult	274.71	147.07	85.35	39.10	88.39	97.32	112.79	53.79	54.48	36.10	92.38	79.89	118.40	-
446	1988	adult	-	-	-	-	-	-	-	-	-	-	-	-	-	233.99
447	1988	adult	257.31	141.66	72.66	35.70	83.60	90.01	101.53	45.26	53.48	35.76	92.45	72.98	117.13	217.31
448	1988	adult	266.94	137.63	80.57	32.46	83.75	96.47	106.01	48.25	45.92	41.28	88.82	73.55	115.16	-
449	1988	adult	279.55	144.72	79.56	-	79.46	104.16	114.32	55.5	56.02	41.21	95.60	79.45	113.51	232.77
451	1988	adult	-	142.39	-	36.49	90.86	-	102.42	-	50.37	-	92.17	78.66	115.23	233.03
452	1988	adult	283.56	140.88	82.75	34.34	82.92	101.96	105.67	48.07	46.82	41.09	90.64	80.37	118.89	280.12
453	1988	adult	289.11	-	77.94	36.50	80.22	107.24	117.54	46.71	59.07	46.10	94.55	83.27	123.93	240.96
454	1988	adult	266.59	139.86	68.64	-	87.66	98.74	100.57	41.91	49.21	36.89	85.71	76.86	120.99	228.3
488	1988	adult	297.01	148.37	81.06	34.44	82.55	109.65	118.58	47.82	56.72	44.79	99.23	85.47	116.64	244.45
529	1988	old	-	-	-	-	-	-	-	-	-	-	-	-	-	-
531	1988	adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-
534	1988	adult	-	-	-	-	-	-	-	-	-	-	-	-	-	266.64

Appendix A. continued...

#	Date	Age	basal l.	orbital w.	nasal l.	post nares	max. tooth rw.	max. diast.	occip. ht.	nasal w.	canine w.	inc.for.	mastiod w.	rostral ht.	zygom. w.	mand.l.
535	1989	adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-
537	1989	adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-
538	1989	adult	-	-	-	-	-	-	-	-	-	-	-	-	-	-
541	1989	old	281.50	149.08	74.36	36.85	90.61	101.16	117.63	49.70	51.52	46.18	96.51	81.86	123.14	237.50
542	1989	adult	265.60	137.53	70.43	34.14	90.82	91.05	108.19	45.51	46.61	36.23	88.77	76.28	112.74	226.20
543	1989	adult	278.68	141.06	78.22	31.15	82.35	101.79	110.33	47.82	48.72	42.13	93.37	79.67	121.22	236.17
544	1989	adult	288.33	147.49	87.88	35.09	76.95	105.72	116.38	52.96	52.78	42.17	99.86	82.21	119.71	244.84
545	1989	adult	281.82	144.65	83.95	35.61	87.56	98.90	115.68	55.24	51.05	55.01	95.82	82.18	119.81	239.68
546	1989	adult	276.84	140.81	81.58	-	86.21	98.64	116.76	52.83	54.28	38.95	94.22	77.39	115.65	232.62
547	1989	old	272.20	149.81	79.08	33.17	80.27	100.6	115.10	51.07	61.13	40.66	99.99	79.16	121.36	233.21
548	1989	adult	267.71	142.11	77.08	36.17	88.91	90.65	105.96	56.40	50.60	35.24	94.87	72.70	116.18	225.52
549	1989	adult	276.32	149.27	70.63	37.89	86.52	95.60	110.09	45.60	57.90	41.32	95.52	83.17	121.48	227.12
552	1989	adult	271.33	144.97	77.98	33.85	87.85	96.29	113.22	49.53	51.41	41.12	96.09	76.06	118.53	229.40
553	1989	adult	281.78	142.98	89.23	33.71	83.16	104.48	105.31	51.90	55.13	38.24	95.29	82.12	116.56	235.34
554	1989	adult	263.31	132.99	67.23	33.22	86.96	95.70	94.58	46.12	47.95	43.06	84.94	74.24	114.35	223.35
555	1989	old	284.73	148.95	84.86	36.69	78.50	104.89	112.63	51.84	57.56	42.77	94.96	83.41	120.04	-
556	1989	old	268.10	141.80	83.40	32.92	78.40	100.94	109.60	53.48	50.65	40.45	92.28	74.36	118.59	223.98
557	1989	adult	282.40	143.82	89.03	-	79.54	104.93	117.09	48.22	56.49	-	94.22	76.36	125.74	-
558	1989	adult	261.40	139.58	73.05	-	85.52	92.76	107.06	46.54	50.59	38.76	90.10	73.23	116.45	225.10

Appendix A. continued...

#	Date	Age	basal l.	orbital w.	nasal l.	post nares	max. tooth rw.	max. diast.	occip. ht.	nasal w.	canine w.	inc.for.	mastiod w.	rostral ht.	zygom. w.	mand.l.
802	1990	adult	270.57	147.82	80.38	37.53	86.34	94.86	-	61.45	53.10	39.30	97.78	74.67	122.62	236.80
803	1990	adult	281.03	-	84.19	-	86.67	105.17	111.76	47.06	56.50	39.62	92.82	82.58	118.89	236.45
805	1990	adult	269.22	-	70.22	33.57	87.19	92.91	109.23	47.06	55.15	-	94.94	77.01	114.48	224.86
806	1990	adult	-	143.65	81.02	40.75	86.29	-	110.70	45.21	50.15	-	94.42	76.45	119.59	-
807	1990	adult	279.43	135.43	88.27	37.37	83.26	101.69	118.56	49.59	54.29	38.86	95.04	76.30	120.91	236.28
808	1990	adult	-	-	-	-	-	-	-	-	-	-	-	-	-	225.68
809	1990	adult	269.23	138.55	79.42	35.73	85.15	98.29	103.06	48.70	49.05	39.96	91.67	76.16	112.68	-
810	1990	adult	280.16	145.64	81.35	34.15	83.57	98.13	111.55	52.54	55.78	41.29	99.67	77.79	119.78	237.26
811	1990	adult	282.34		81.00	38.87	83.33	102.77	115.95	49.51	55.09	39.07	99.00	83.90	118.10	239.04
812	1990	adult	274.81	146.69	82.27	36.96	79.31	97.66	111.06	52.95	56.44	39.94	98.32	73.53	116.93	229.70
813	1990	adult	268.04	140.98	85.42	34.71	77.51	97.23	108.10	41.22	44.55	39.08	94.48	71.53	115.81	222.93
814	1990	adult	287.45	149.40	86.01	34.48	79.73	105.14	113.33	54.47	54.59	44.31	96.21	83.25	118.38	240.90
815	1990	adult	282.84	-	90.50	34.91	83.44	101.61	115.54	54.05	50.88	42.12	96.13	76.08	123.19	243.87
817	1990	adult	300.31	159.31	88.31	38.56	83.01	113.05	118.40	51.35	59.96	44.59	94.85	79.04	121.81	243.10
818	1990	adult	288.73	157.02	75.41	40.55	76.93	106.53	123.04	46.66	59.32	41.61	98.99	85.54	123.95	241.96
819	1990	adult	266.51	136.20	-	34.71	89.02	92.58	110.88	-	50.93	37.86	89.53	-	116.33	230.28
820	1990	adult	272.95	142.49	84.39	37.70	80.61	99.34	111.31	48.62	55.03	43.44	90.44	78.66	116.24	230.21
821	1990	adult	270.49	148.81	69.39	34.60	90.60	95.76	111.63	50.51	54.96	38.80	94.41	80.35	119.58	225.12

Appendix A. continued...

#	Date	Age	basal l.	orbital w.	nasal l.	post nares	max. tooth rw.	max. diast.	occip. ht.	nasal w.	canine w.	inc.for.	mastiod w.	rostral ht.	zygom. w.	mand.l.
822	1990	adult	-	-	-	-	-	-	-	-	-	-	-	-	-	239.62
823	1990	adult	263.89	136.10	77.66	35.99	86.32	92.88	-	50.39	49.69	36.76	89.14	-	117.15	222.49
7760	1989	old	-	130.75	78.27	34.17	83.19	-	99.15	49.33	-	-	90.54	72.94	120.81	-
7762	1989	old	-	149.42	93.81	36.94	88.38	-	107.84	49.73	56.93	-	95.53	78.98	121.20	-
7763	1989	old	-	147.28	85.90	35.90	80.07	-	117.95	53.85	-	-	95.57	78.82	123.29	-
7764	1989	old	-	-	67.99	35.95	77.92	-	103.07	49.03	-	-	91.02	77.17	118.02	-
7765	1989	old	-	142.45	76.74	34.57	80.99	-	97.88	52.94	57.96	-	90.73	77.18	-	-
7766	1989	old	-	-	-	-	-	-	-	-	-	-	-	-	-	231.32
7767	1989	old	293.34	143.74	88.29	-	85.58	104.16	117.53	55.58	53.87	34.86	97.95	80.58	119.69	243.01
7768	1989	old	285.62	147.08	96.13	38.93	82.70	103.16	120.41	52.88	56.86	38.90	99.39	78.45	121.55	238.02
7769	1989	old	-	-	82.38	36.75	81.43	-	113.04	49.53	-	-	95.20	79.93	122.25	230.04

Appendix A. continued...

#	Date	Age	mand. diastema	condobas. l.	mand. ht.	mand. tooth rw.
231	1987	old	-	315.33	-	80.15
232	1987	adult	87.57	307.83	-	101.75
233	1987	adult	87.17	297.39	90.71	97.11
235	1987	adult	85.01	-	99.94	94.70
236	1987	old	106.4	308.58	104.68	92.35
237	1987	old	88.54	-	-	94.29
340	1987	adult	89.38	299.54	96.92	94.08
341	1987	adult	83.98	-	97.66	97.77
345	1987	adult	95.05	-	108.90	96.83
347	1987	adult	81.89	293.35	99.87	96.56
348	1987	adult	-	-	-	-
349	1987	adult	-	-	-	-
350	1987	adult	88.48	297.56	94.43	93.58
351	1987	adult	92.78	308.19	104.90	95.94
352	1987	adult	81.11	290.13	95.04	98.40
353	1987	adult	-	295.63	-	-
354	1987	adult	88.89	290.29	95.56	81.28
431	1988	adult	85.99	298.89	99.41	100.94
432	1988	adult	-	295.54	100.00	94.08
433	1988	adult	95.6	317.67	106.88	94.96
434	1988	adult	83.9	391.57	93.60	97.42
435	1988	adult	82.45	284.73	-	97.96
436	1988	adult	83.01	293.58	97.16	99.78
438	1988	adult	84.38	296.20	101.72	92.70
440	1988	adult	85.56	296.62	99.05	101.33
441	1988	adult	-	292.72	99.60	104.50
442	1988	old	100.43	323.37	102.69	98.59
443	1988	adult	95.09	317.26	107.07	100.49
444	1988	adult	-	294.22	91.60	102.06
446	1988	adult	84.18	-	-	96.35
447	1988	adult	76.1	277.34	96.38	95.10
448	1988	adult	-	283.99	96.41	91.71
449	1988	adult	90.43	299.84	95.74	91.26
451	1988	adult	83.21	-	-	98.83
452	1988	adult	108.35	302.02	113.08	96.54
453	1988	adult	89.64	307.96	98.23	92.76
454	1988	adult	87.39	287.79	81.53	93.17
488	1988	old	96.17	318.05	97.17	94.49
529	1989	adult	100.92	-	-	96.80
531	1989	adult	107.73	-	-	98.78
534	1989	adult	-	-	115.30	-
535	1989	adult	97.67	-	-	91.90
537	1989	adult	-	-	-	96.13
538	1989	adult	93.12	-	-	88.75
541	1989	old	85.86	303.50	101.14	99.39
542	1989	adult	80.80	287.17	89.95	101.07
543	1989	adult	85.54	300.20	98.07	96.29

Appendix A. continued...

#	Date	Age	mand. diastema	condobas. l.	mand. ht.	mand. tooth rw.
544	1989	adult	90.65	305.77	100.94	89.71
545	1989	adult	83.46	302.96	108.74	101.39
546	1989	adult	95.16	297.29	97.01	84.63
547	1989	old	88.97	292.27	105.16	87.64
548	1989	adult	80.22	287.50	93.73	101.47
549	1989	adult	84.61	296.42	109.15	97.62
552	1989	adult	82.67	291.78	98.17	98.65
553	1989	adult	87.92	299.80	92.44	95.21
554	1989	adult	79.49	283.02	90.20	100.33
555	1989	old	-	305.99	-	-
556	1989	old	84.76	285.54	89.42	93.16
557	1989	adult	-	301.56	114.13	90.02
558	1989	adult	80.66	277.52	87.82	93.00
802	1990	adult	86.28	291.18	97.57	95.20
803	1990	adult	87.45	300.24	101.96	98.42
805	1990	adult	76.45	288.98	93.36	100.32
806	1990	adult	-	-	104.99	-
807	1990	adult	89.93	303.65	102.88	92.59
808	1990	adult	85.82	-	104.59	96.60
809	1990	adult	86.26	289.04	-	96.43
810	1990	adult	84.85	297.57	100.19	93.33
811	1990	adult	87.63	302.51	102.94	92.55
812	1990	adult	84.74	294.16	107.77	88.18
813	1990	adult	83.85	286.69	93.77	87.82
814	1990	adult	92.27	307.78	106.04	89.04
815	1990	adult	84.90	302.98	93.47	94.64
817	1990	adult	97.71	318.12	104.46	74.37
818	1990	adult	93.20	308.21	97.28	88.66
819	1990	adult	81.08	284.52	96.09	101.47
820	1990	adult	85.44	293.12	97.51	91.09
821	1990	adult	82.60	291.62	99.28	99.32
822	1990	adult	91.67	-	102.32	92.21
823	1990	adult	81.23	283.38	93.43	93.38
7760	1989	old	-	-	-	-
7762	1989	old	-	-	-	-
7763	1989	old	-	-	-	-
7764	1989	old	-	-	-	-
7765	1989	old	-	-	-	-
7766	1989	old	82.07	-	98.64	90.42
7767	1989	old	91.49	316.81	97.49	95.53
7768	1989	old	91.20	306.14	-	93.66
7769	1989	old	86.06	-	101.64	95.41

Appendix B. Female caribou skull measurements (mm) - Pelly Bay

#	Date	Age	basal l.	orbital w.	nasal l.	post nares	max. tooth rw.	max. diast.	occip. ht.	nasal w.	canine w.
379	1988	adult	-	142.89	89.40	37.07	86.64	-	119.28	47.83	59.38
380	1988	adult	290.29	149.67	82.40	-	88.07	105.50	120.85	52.38	53.21
381	1988	adult	295.68	148.21	96.00	-	86.12	109.48	113.92	54.51	55.41
382	1988	adult	304.02	-	90.43	-	83.12	112.82	124.22	49.72	65.90
383	1988	adult	-	-	-	-	-	-	-	-	-
384	1988	adult	-	155.73	82.58	39.69	99.76	-	125.66	51.78	54.26
385	1988	adult	-	155.36	88.88	41.46	81.56	-	124.84	56.75	-
386	1988	adult	306.99	144.97	85.52	-	81.95	112.24	128.55	45.59	60.77
387	1988	adult	-	138.99	88.39	-	86.23	-	113.37	42.12	52.48
389	1988	adult	-	143.28	88.22	-	93.54	-	109.75	49.72	48.85
390	1988	adult	313.34	155.23	92.72	40.58	90.75	115.76	128.39	48.83	54.67
391	1988	adult	291.85	147.42	-	40.24	86.85	105.25	114.47	50.78	54.88
392	1988	adult	293.09	146.68	87.20	35.67	84.85	109.37	122.06	53.71	61.70
393	1988	adult	-	-	-	-	-	-	-	-	-
394	1988	adult	272.22	143.19	78.44	34.62	83.87	94.97	117.48	58.77	54.67
395	1988	adult	280.51	137.90	68.39	37.91	89.32	100.26	115.37	46.78	51.31
396	1988	adult	303.46	150.12	83.01	38.63	88.39	107.81	126.93	48.15	62.90
397	1988	adult	-	-	64.44	37.31	86.50	-	112.84	50.80	50.19
398	1988	adult	289.97	-	94.08	-	91.32	107.30	119.77	53.69	56.34
636	1988	adult	296.82	152.58	92.59	-	89.61	106.67	-	49.83	57.02
637	1988	adult	308.02	150.57	85.15	37.01	83.13	114.75	126.36	62.92	64.91
638	1988	adult	308.13	146.11	92.03	39.97	93.13	112.83	121.47	53.90	58.34

Appendix B. continued...

#	Date	Age	inc. for.	mastoid w.	rostral ht.	zygom. w.	mand. l.	mand. diast.	condobas. l.	mand. ht.	mand. tooth rw.
379	1988	adult	-	94.43	73.85	122.17	235.86	89.48	-	104.32	94.89
380	1988	adult	44.82	101.51	91.85	125.91	247.32	90.21	312.56	-	99.77
381	1988	adult	50.86	100.80	78.81	118.13	251.49	94.37	317.22	97.39	95.66
382	1988	adult	41.88	102.53	85.05	132.32	254.62	96.61	325.52	103.74	95.22
383	1988	adult	-	-	-	-	251.40	95.34	-	91.53	94.40
384	1988	adult	-	102.20	79.07	126.80	255.73	93.72	-	103.70	109.30
385	1988	adult	-	109.06	89.09	123.68	252.48	99.05	-	99.06	91.13
386	1988	adult	53.85	96.39	87.75	118.19	-	97.67	330.23	-	93.08
387	1988	adult	-	88.45	77.54	117.55	246.04	105.25	-	92.89	86.71
389	1988	adult	-	94.40	79.01	117.06	235.85	86.02	-	83.82	102.95
390	1988	adult	50.11	112.62	80.97	127.46	-	101.24	334.02	-	100.33
391	1988	adult	39.24	97.27	80.18	119.54	245.87	88.19	312.68	112.40	97.64
392	1988	adult	37.70	95.63	85.94	118.71	253.19	94.19	311.54	101.76	94.82
393	1988	adult	-	91.30	-	-	245.45	94.25	-	92.57	99.95
394	1988	adult	37.25	93.55	80.55	114.85	232.50	81.13	292.48	91.92	95.16
395	1988	adult	47.66	90.68	76.87	-	241.93	91.29	300.36	85.58	95.02
396	1988	adult	42.98	104.37	82.06	124.90	248.32	93.13	325.77	107.67	99.97
397	1988	adult	-	89.78	80.60	119.53	231.68	84.13	-	78.46	97.74
398	1988	adult	46.21	97.52	79.80	-	248.29	91.04	310.33	100.49	105.59
636	1988	adult	43.95	98.90	82.27	123.40	255.68	97.54	314.76	113.58	96.42
637	1988	adult	41.79	105.30	86.27	125.13	253.95	96.98	327.23	103.10	91.04
638	1988	adult	35.45	104.24	86.74	125.42	261.43	98.48	329.55	102.45	104.90

Appendix C. Female caribou dental measurements (mm) - Victoria Island

#	year	age class	(pm) premolar row	(m1) 1st mand. molar l.	(m2) 1st mand. molar ht.	#	year	age class	pm	m1	m2
231	1987	old	38.60	13.97	8.45	438	1988	adult	39.06	14.05	11.48
232	1987	adult	41.75	15.32	9.28	440	1988	adult	42.87	16.23	11.60
233	1987	adult	41.10	14.69	11.62	442	1988	old	40.07	14.61	9.50
235	1987	adult	39.47	15.73	13.11	443	1988	adult	40.83	15.75	10.80
236	1987	old	39.28	14.24	6.16	444	1988	adult	42.01	15.77	10.91
237	1987	old	42.32	15.63	5.53	446	1988	adult	39.78	14.34	11.53
340	1987	adult	38.43	15.01	11.33	447	1988	adult	40.65	13.69	11.95
341	1987	adult	39.24	14.39	12.34	448	1988	adult	38.12	15.72	10.16
354	1987	adult	37.32	14.74	10.08	449	1988	adult	36.14	13.97	9.38
347	1987	adult	38.52	14.13	10.93	451	1988	adult	43.08	16.07	11.37
350	1987	adult	37.69	15.23	12.35	452	1988	adult	40.81	14.99	10.20
351	1987	adult	40.18	14.67	11.03	453	1988	adult	40.67	14.96	7.46
352	1987	adult	39.76	15.67	12.17	454	1988	adult	38.30	16.38	11.27
354	1987	adult	34.54	13.66	6.17	488	1988	old	37.99	15.61	10.47
431	1988	adult	42.15	15.53	12.81	529	1989	adult	36.77	14.28	8.11
432	1988	adult	39.12	14.66	11.30	531	1989	adult	40.31	15.64	10.92
434	1988	adult	39.36	14.19	8.79	534	1989	adult	41.12	15.67	8.38
435	1988	adult	41.61	14.47	10.67	535	1989	adult	37.22	15.36	6.25
436	1988	adult	40.06	15.95	12.65	537	1989	adult	41.37	13.95	9.05
438	1988	adult	39.67	15.75	12.47	538	1989	adult	33.42	13.87	8.44

Appendix C. continued...

#	year	age class	pm	m1	m2	#	year	age class	pm	m1	m2
540	1989	adult	41.04	16.04	5.39	807	1990	adult	35.91	14.62	11.40
541	1989	old	40.23	15.78	12.84	808	1990	adult	39.62	15.09	10.13
542	1989	adult	42.16	15.88	11.36	809	1990	adult	40.43	14.82	8.49
543	1989	adult	39.62	13.74	9.39	810	1990	adult	40.80	14.28	10.20
544	1989	adult	36.51	13.23	4.60	811	1990	adult	37.66	14.14	10.36
545	1989	adult	41.22	15.67	8.37	812	1990	adult	36.67	13.64	8.08
546	1989	adult	41.55	14.65	11.09	813	1990	adult	36.74	13.38	8.08
547	1989	old	65.58	13.19	7.31	814	1990	adult	36.63	14.00	6.49
548	1989	adult	43.10	15.14	10.49	815	1990	adult	38.55	14.47	9.06
549	1989	adult	40.62	15.27	11.12	817	1990	adult	40.66	13.99	9.75
552	1989	adult	42.83	15.68	11.09	818	1990	adult	35.71	13.95	8.41
553	1989	adult	36.85	15.58	10.58	819	1990	adult	42.66	16.61	13.21
554	1989	adult	43.45	15.92	13.83	820	1990	adult	36.64	14.23	10.77
556	1989	old	38.54	13.41	8.40	821	1990	adult	40.58	15.14	10.17
557	1989	adult	34.23	14.22	5.21	822	1990	adult	38.05	15.22	9.70
558	1989	adult	40.08	15.76	12.02	823	1990	adult	39.19	15.59	11.59
802	1990	adult	39.53	16.38	11.48	7766	1989	old	37.55	13.00	7.59
803	1990	adult	42.67	14.77	11.29	7767	1989	old	38.22	14.37	7.81
805	1990	adult	42.26	15.43	11.50	7768	1989	old	37.78	14.21	7.04
806	1990	adult		14.36	8.59	7769	1989	old	38.02	14.61	8.87

Appendix D. Female caribou dental measurements (mm) - Pelly Bay

#	year	age class	pm	m1	m2
379	1988	adult	38.94	15.61	9.11
380	1988	adult	40.64	13.86	11.76
381	1988	adult	40.13	14.03	10.27
382	1988	adult	40.41	15.82	6.97
383	1988	adult	39.07	15.15	9.44
384	1988	adult	47.53	16.79	13.92
385	1988	adult	36.03	14.03	9.08
386	1988	adult	38.65	15.55	8.75
387	1988	adult	33.24	14.96	9.97
389	1988	adult	45.79	16.28	13.94
390	1988	adult	41.65	15.30	13.33
391	1988	adult	40.08	13.85	8.34
392	1988	adult	38.97	14.27	7.57
393	1988	adult	42.89	15.05	11.93
394	1988	adult	40.25	15.16	12.61
395	1988	adult	39.41	16.10	11.73
396	1988	adult	41.81	14.81	9.91
397	1988	adult	39.69	15.78	11.80
398	1988	adult	45.31	15.39	10.33
636	1988	adult	39.79	15.32	10.76
637	1988	adult	40.12	15.41	7.02
638	1988	adult	41.49	17.10	12.18